University of Western Sydney

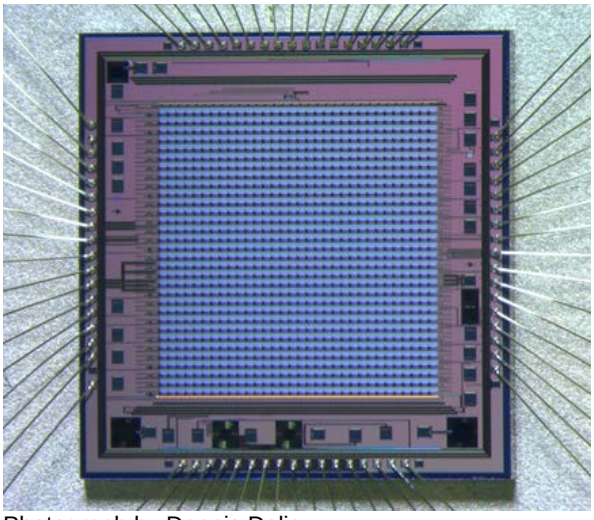
RESEARCH DIRECTIONS

Integrated circuit models: The future of advanced light detector technology

Dr Tara Hamilton from the MARCS Institute and Dr Dennis Delic from the Defence Science and Technology Organisation (DSTO) have received funding to redesign light detector chips for increased efficiency, picture clarity, and decreased size. This research aims to make the devices significantly smaller, and create a world first high-density version. An up-and-coming researcher from the University of Western Sydney, Mr Libin George will also work on this project.

'In low light environments, human eyes may struggle to spot images, and so we have developed technology to do the seeing for us', Dr Hamilton says. 'SPAD (Single Photon Avalanche Diode) is a type of image sensor chip able to detect individual light particles, and is currently used by the DSTO in low-resolution LIDAR (Light Detection and Ranging) equipment like remote sensor devices. However, the accuracy of the integrated circuit versions of SPAD devices comes at the cost of image clarity – a photo taken on a smartphone is clearer than the average SPAD image.' To correct this, the research team will aim to minimise and streamline these sensors for clearer image capture.

To improve the clarity of the images from SPAD chips, the number of pixels used must be increased, but increasing pixels with traditional methods will also increase the size and the power it consumes, limiting the spaces where it can operate. The team will instead experiment with alternative semiconductor materials and layouts within the SPAD integrated circuits as a way to make them smaller – for example, the ideal size of the "counting circuit" should be less than 50 x 20 micrometres in total. This new design should be compact, and use less power per pixel than present models. The MARCS Institute and DSTO laboratories will be used to produce the prototype chips, which will then be tested against other circuit designs.



Photograph by Dennis Delic

An efficient, smaller version of the SPAD chip would have a wide variety of applications in military science, space exploration, and robotics innovations. An immediate use for the Australian Defence Force would be in high-resolution LIDAR technologies, such as facial recognition software, that could be employed to track security threats with accuracy over long distances.

Project Title: Optimisation of supporting circuits in high-density SPAD arrays
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